PROJECT 42 - MODEL 504

DESIGN

The primary function of the Model 504 is to provide airborne angle deception of X-band conical scan tracking radars through the use of the inverse gain technique. Provision for performing velocity gate pull-off of X-band CW doppler radars was also included. The equipment uses two cascaded TW tubes with a maximum output power of one watt. Inverse gain is performed by applying modulation of the proper phase and frequency to the grid of the output TWT while velocity gate pull-off is performed by serradyne modulation of the helix of the output TWT. The output TWT is maintained in a cut-off condition until the Model 504 is illuminated continuously by either a pulse or CW signal. The type of signal received determines the mode of operation of the equipment.

The block diagram of the Model 504 is shown in Fig. 1. The incoming r-f signal first passes through a dual purpose ferrite modulator. For CW signals, the ferrite modulator facilitates detection by modulating the CW signal at a 10 kc rate. When pulsed r-f signals are detected the ferrite modulator is used to provide AGC action which prevents saturation of the input TWT with consequent loss of scan frequency information and also acts to maintain the peak r-f output at close to the one watt maximum.

The input TWT provides 25 db of r-f gain and drives both the output TWT and the crystal detector through a power divider. The detected signal is amplified by the video amplifier. In the presence of a CW signal, the 10 kc modulation is further amplified by the 10 kc amplifier and synchronously detected by the CW detector. In the presence of a pulsed signal the scan demodulator recovers the pulse 6

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amplitude information and pulse modulation or scan frequency information. The pulse amplitude information is filtered and fed to the AGC amplifier. The scan signal is amplified and fed to the pulse detector and to the grid of the output TWT to provide the inverse gain function.

When a CW signal is detected, the serradyne generator is enabled and a swept-frequency sawtooth is applied to the helix of the output TWT to provide the velocity gate pull-off function. The sawtooth frequency is swept from 200 cps to 20 kc on a two-second, repetitive basis.

The output TWT provides 35 db of r-f gain and delivers up to 1 watt of r-f power into the output horn. Both the input and output horns are circularly polarized and have 3-db beamwidths of about 40 degrees.

With the exception of the regulated high voltage supplies, the circuits are completely transistorized. The 504 is powered by 28 v dc and requires 100 watts on standby and 150 watts when active.

CONSTRUCTION

The Model 504 is housed in a container whose width, height and length are 12-1/8", 4-5/8", and 18-1/2", respectively. The input and output horns are bolted to the cover of the container and increase the overall length to 25". The weight of the complete unit is 35 pounds.

The cover of the container is integral with the chassis. The chassis slides into the container and the necessary electrical connections are made by means of mating connectors at the rear of the assembly. Guide pins are provided to insure that the connectors mate properly. The male connector is fastened to the container

and is an hermetically sealed type. A rubber gasket around the cover and pressurizing flanges at the horns make the container relatively air tight. An air fitting at the back of the container allows the unit to be pressurized at high altitudes. Another fitting is used to monitor the container pressure.

Cooling of the equipment is a two-step process: a blower is used inside the unit to circulate air through the output TWT and around the inside of the container. The container is then cooled by passing outside air over its surface.

INSTALLATION

The 504 is mounted in the rear of the aircraft over the jet exhaust in the location formerly occupied by the drag chute. The unit is installed from the outside by sliding it into the drag chute opening. A fiberglas radome is then slipped over the horns and bolted to three brackets mounted on the container. The radome is then fastened by means of two hinge-pin assemblies to the aircraft. Air and electrical connections are made through a small access hatch. Air scoops are provided on the skin of the aircraft to pick up cooling air which is passed over the container and out through the radome.

A control box for the 504 is located in the pilot's compartment. Two switches are provided; one being the main power switch, and the other being an enable switch which allows the 504 to be held in a standby condition. An amber light is provided which indicates the detection of an r-f signal, either pulse or CW. A green light indicates the condition of the enable switch.

An altimeter is also located in the pilot's compartment to allow the container pressure to be monitored. The container pressure is a function of aircraft altitude, but is always greater than 4.5 PSI.

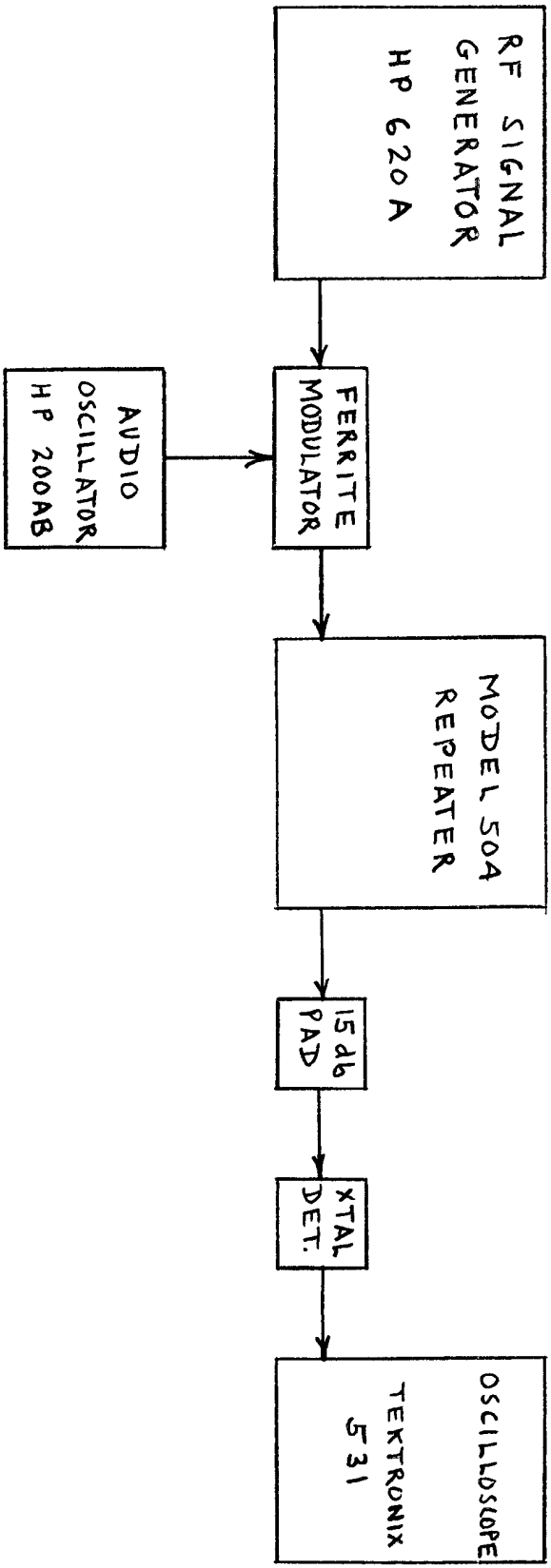
Both the received and transmitted signals are sent from the 504, in a suitable form, over coaxial cable to a magnetic recorder located in the midsection of the aircraft. A third channel of the recorder is used to record radio communications. At the completion of a mission the tape may be played back and analyzed as a check on the performance of the 504.

CHECK-OUT PROCEDURE

A thorough check of the performance of the 504 can be made without removing the unit from the aircraft. It is necessary, however, to remove the radome and to replace the horns with waveguide to coax adapters. The test setup shown in Fig. 2 is then used.

The RF signal generator puts out either pulse or CW signals and the calibrated output attenuator allows the 504 sensitivity to be determined for either mode. The ferrite modulator is used to simulate conical scan modulation of a pulse signal. The audio oscillator allows the modulation depth and scan frequency to be varied.

The r-f output of the 504 is attenuated by the 15 db pad to avoid damaging the crystal detector. The output of the crystal detector is viewed on the oscilloscope so that the response of the 504 to pulse signals may be readily determined.



TEST SETUP - MODEL 504

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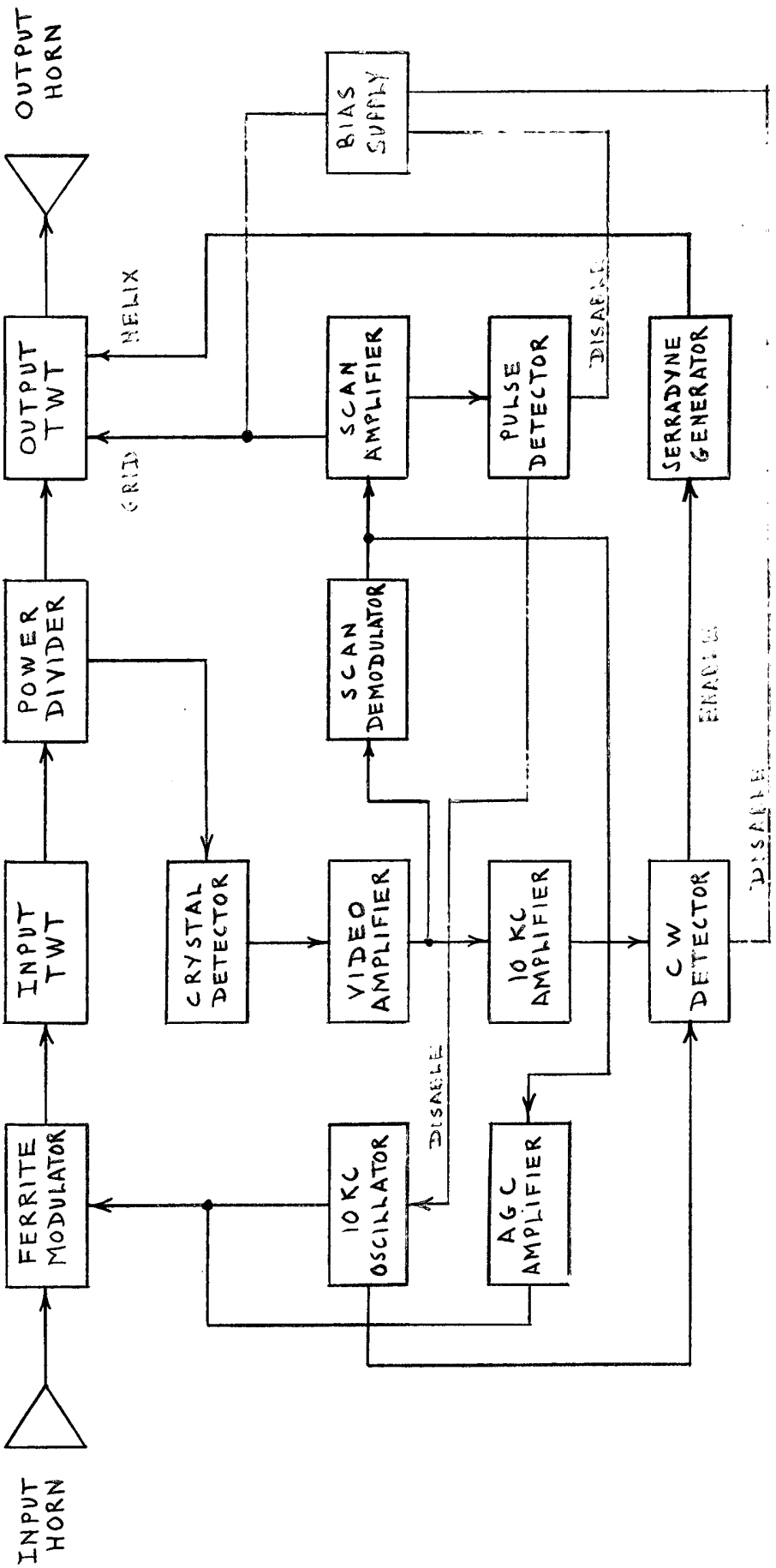
FIG 2



BLOCK DIAGRAM - MODEL 504

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FIG 1